to easily turn and set the instrument to right ascension. This can be understood from Fig. 3, which is from a photograph. In the case of an instrument of the size of the Vienna equatorial, the observer requires an elaborate stage or platform of variable height and position in order to reach the eye-end, and if he has to move to another object he must descend from his chair or platform and move *it* before he can move the instrument, and then he has not the facility of sighting objects, but must adopt a sort of tentative process, climbing up and down his stage and moving it and the telescope alternately. To avoid this labour and save time an arrangement is supplied by which the assistant from the ground floor can set the instrument in right ascension, and once set in one direction, the other (declination setting) can be readily managed by the observer. The assistant is supposed to stand at the south end of the pier. He has there before him a desk on which his catalogue and paper can rest, a sidereal clock-face let into the south end of the pier, a reader telescope by which he can read the lower right ascension circle, and a hand-wheel, which by means of shafts and gearing communicate motion to the instrument in right ascension, and finally a handle which is keyed on to a screw forming the toe-bearing of the quick motion driving-shaft. By giving this handle one turn, the driving-shaft is allowed to drop down out of gear with the rest of the wheelwork, so that the clock when driving the instrument may not have the additional work to do of driving this shaft, which is necessarily a quick one as compared to the motion of polar axis itself. A lamp is attached to pier at west side, which serves to throw light on sidereal clock-face, catalogue, &c., on desk, and also to send a beam of light up through a long tube directed to the vernier of the right ascension circle which is visible through the reader. The assistant has therefore full power of setting the instrument roughly, or if desired with any degree of accuracy, in right ascension, or reading off the right ascension of an object which requires to be identified.

The tube of the telescope is made of steel plate about one-eighth of an inch thick in the centre, and tapering to about one-twelfth of an inch at the ends, the points being all lapped and riveted; it is 33½ feet in length, and lessens from 36½ inches in diameter in the centre to 27 inches at the one and 12 inches at the other end. The weight of the moving parts is between six and seven tons, and still the whole is under easy control of the muscular power of one arm.

The Commissioners appointed by the Austro-Hungarian Government to report on this telescope consisted of Prof. Ball, Astronomer-Royal for Ireland, Earl of Crawfurd and Balcarres, Mr. Huggins, Prof. J. Emerson Reynolds, Earl of Rosse, Prof. Stokes, Dr. G. J. Stoney, and Mr. Walsh, the Austro-Hungarian Consul at Dublin. On March 16 this Commission forwarded to the Austro-Hungarian Embassy in London their full approval of the performance of the instrument, thus marking the successful completion of the largest refracting telescope in existence.

It will be remembered that Mr. Grubb has built among other fine instruments the great Melbourne Reflector, the largest equatorially-mounted telescope known. He has not rested on his laurels, but is now to be cordially congratulated on a still greater accomplishment.

WHEWELL ON COLOURING GEOLOGICAL MAPS

ONE of the subjects to be brought forward for discussion at the International Geological Congress to be held this year at Bologna is the *unification des figurés;* that is to say, an attempt will be made to come to some agreement as to the signs and colours to be used on geological maps. Two things have to be indicated: *succession, i.e.* the stratigraphical position of the rock; and *formation*, by which, adopting a terminology now in much favour on the Continent, we mean the lithological character and origin of the rock, and not, as is generally understood by the word in this country, a subdivision of the stratigraphical series. I have found among Prof. Sedgwick's papers a scheme drawn up by Dr. Whewell nearly half a century ago, which I have thought might be of use to those who are considering this question, and of interest to many besides. It is dated from Dublin, 1835, where he was attending the meeting of the British Association, and it was probably suggested by the publication of Griffiths' map.

William Smith shaded up to the lowest beds of the various groups into which he divided the strata, in order by contrast to mark more strongly the coming in of a new series, but he does not seem to have adopted any system beyond sometimes taking such tints as were suggested by the predominant colours of the rocks represented. Salter, I remember, proposed a scale of colours founded on the spectrum, but the scheme proposed by the late Master of Trinity I do not remember to have seen put forward before.

THOS. MCK. HUGHES

Trin. Coll., Cambridge, April 26

Proposal for a Systematic Scale of Geological Colours

THE objects which it would be desirable to secure in fixing the scale of colours for a geological map appear to be the following:—

1. That the different members of the geological series should be coloured in a manner somehow depending on their *place in that series*, so that successive rocks are distinguished.
2. That *this* distinction (of succession) should be governed by some *general principle*, and should not be merely arbitrary; so that without referring to the index list the colour itself should show the difference of older and younger in the rock.
3. That the colours should also show the great leading differences of the material of the strata (limestone, sandstone, clay), so that without referring to the scale these differences should be known from the colour.
4. That *igneous* rocks should by some general circumstance in the colour be distinguished from sedimentary.
5. That the colours which are brought near each other by proximity of succession should be strongly *contrasted.*

The following method would, I think, secure these objects. It proceeds on the supposition that there are three primary colours—Red, Yellow, Blue—and that any two of these mixed in considerably different proportions make several shades of intermediate colour; thus between red and yellow we have many shades of orange, proceeding from pure red, through reddish orange, to orange, yellowish orange, and pure yellow; in like manner we have many shades of green between yellow and blue, and many shades of purple between red and blue. Our scale can be subdivided as far as these shades are distinguishable. We have also black, which can be combined in various proportions with each of the simple colours; thus black with successive doses of red makes brown more and more red.

The general principles which I propose are these:—

1. Let one of the above four simple colours represent the material and another the order of succession, and let successive mixtures represent successive strata of the same material. Thus let the oldest *limestone* be pure *blue*, let doses of yellow be added to mark newer and newer limestones, the chalk being a very yellow green; thus all the oolite series will be green of different shades.
2. Let the simple colour which represents succession be different for different materials, thus let *blue* represent succession for the *clays*, and let all the clays be *purple*, the oldest therefore being the reddest, and the newest the bluest purple.

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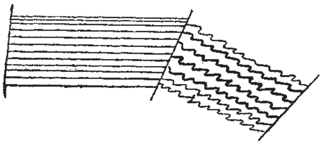
In the same way let black represent *sand* strata, and let *red* represent *succession* in such strata; then the sandstones will be represented by *browns*, the oldest being the blackest, and the newest the reddest brown.

3. Let igneous rocks be represented by a general colour, as *red*, and let any order which obtains among them (succession, for example, if succession can be traced) be marked by doses of another colour, as yellow; then the igneous rocks will be all red or orange, the newest being the yellowest.

4. Let other differences (as mineralogical differences) be represented by other means, as by *hatching*. Thus granite and quartz rock, if contemporaneous, may be marked by red with the addition of lines—



According to these principles the English strata would be represented by the following colours, which may thus be denoted by letters; let Red, Yellow, Blue, *Black*, be marked by R, Y, B, *A*, and let mixtures be represented by combinations of the letters. Then we have—

Orange, R R R Y, R R Y, R Y, R Y Y, R Y Y Y.
Green, Y Y Y B, Y Y B, Y B, Y B B, Y B B B.
Purple, B B B R, B B R, B R, B R R, B R R R.
Brown, A R R R, A R R, A R, R A A, R A A A.
Unstratified rocks (primary), R.
„ „ (trap), R R Y, R Y, R Y Y, &c.
Clay slate, B R.
Oldest limestone, B, B B B Y, B B Y.
Oldest sandstone, A, A A A R, A A R.
Secondary limestone (Mountain), B Y.
New red sandstone „ A R.
Oolites „ B Y Y, B Y Y Y.
Green sand „ A R R.
Chalk „ B Y Y Y Y.

Observations:—1. The method here proposed would answer the objects above stated, for the material and order of succession are marked by their proper colours; and the sands, clays, and limestones which occur near each other would be very distinct. Thus the green sand is reddish brown (A R R) and the chalk is yellow green (B Y Y Y Y).

2. Perhaps it may appear an inconvenience that contiguous members of a formation of the same material are proximate shades of the same colour: thus the oolite beds would be successive shades of green (B Y Y, B Y Y Y), and might be difficult to distinguish. I answer, that the beds themselves are often difficult to distinguish, so that our language is most indistinct when our knowledge is most indistinct; again, that the inconvenience, when it is one, may be remedied by marking or hatching those strata; again, that no systematic method can be devised which will not be open to this objection.

3. The above principles being adopted, the whole range of the colours, as modified by the *succession-colour*, might be different according to the different object of the geologist. Thus if he had to exhibit the whole geology of England, *all* limestones whatever must come in between B and Y (Blue and Yellow). But if he take the secondary period only, he may use all the possible shades of green for members of that part of the series alone, and may thus make his terms more numerous.

4. If the *whole* range of the *succession-colour* be employed and exhausted on a *part* only of the geological series of strata, the strata which occur beyond this part will, in the scale used on such occasions, be without representative colours. This is an inevitable evil. We cannot combine the extremes of detail and generality. If we use all our means in expressing a part, we must for the time omit to express the remainder. We must do this when our purpose requires and justifies it.

5. When we use all our colours for part of the geological series, we still preserve the principles above proposed and the advantages which they secure, namely, that the material and the succession are both exhibited in an intelligible way without reference to the index.

6. If we thus make a part of the geological succession to occupy the whole power of our successive colour, we have different colours from those which we have when we represent the whole succession. The partial map has a different index from the general one. This is a serious evil, and must not be incurred without strong necessity.

7. It may be mentioned as an advantage of the proposed notation that many of the colours which are used in it agree very nearly with colours commonly used: as red for granite, blue for older limestones, yellow, or yellow-green for chalk, brown for some sandstones, purple for clays. The main novelties are that the oolites are green, and the coal-fields not black; but as to the latter point, query, whether a *coal* stratum be a proper geological distinction? If the coal-measures be sand or clay beds, they should be brown or purple, according to the material which is taken as characteristic.

In a given case we may have to determine the question above suggested, whether we should employ the whole range of our succession colours on a limited geological period, as, for example, the transition-period. In order to decide this consider what you want. How many limestones have you? How many sandstones, how many clay-rocks, which are to be distinguished? If the oldest limestone be pure blue, and mountain limestone pure green (B Y), we can easily interpose three or four limestones, as (B B B B Y, B B B Y, B B Y); is this a sufficient number of terms for you? and so of the rest.

Summary.—Let there be in all cases a *material colour* and a *succession colour*, namely—

	Material.	Succession.	
Limestone	B ...	Y ...	(Green)
Sandstone (black) ...	A ...	R ...	(Brown)
Clay	R ...	B ...	(Purple)
Igneous Rocks	R ...	Y ...	(Orange)

The latter two lines lead to no confusion, for though R in the clays indicates the material, it is never to be used without B, and R in igneous rocks is never used with B.

It may be observed that in the preceding scheme I have not exhausted the power of colour, for I have not used either the combinations of *black with blue* or of *black with yellow*, or the combination of *three* simple colours. W. W.

Dublin, August 17, 1835

NOTES

We are glad to learn that the Italian Government has decided on having a deep-sea expedition in the course of this summer to explore the Mediterranean. The necessary arrangements are now being made by Prof. Giglioli, the eminent zoologist, at Florence, who will take charge of the biological part of the work. Capt. Magnaghi will be intrusted with the physical part of the work, as well as with the command of the vessel. The scientific results may be expected to be of especial interest, because nothing has been done to explore the depths of the Mediterranean beyond the short cruise in H.M.S. *Porcupine* in 1870.

Prof. Tyndall has written to the *Times* of yesterday a letter of great interest on the attitude of the late Mr. Carlyle towards modern science, which it has been taken for granted was purely hostile. But according to Prof. Tyndall, not only was Mr. Carlyle deeply interested in some of the latest researches of science, but he took great and successful pains to understand

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